ENVIROSCAN, INC.

ORIGINAL

SEMS DocID 2332340

Final Report
Geophysical Survey
Unexploded Ordnance Detection/Delineation
New Jersey Fireworks Site
Five (and Optional Sixth) Burn/Disposal Pit Areas
Totaling Approximately 5.4.Acres
Elkton, MD
Enviroscan Project Number 110721

Prepared For: Tetra Tech EM Inc.
Prepared By: Enviroscan, Inc.
February 25,2008

MARINE SEARCH AND SURVEY • MARINE GEOPHYSICS • a division of ENVIROSCAN, INC.

1051 Columbia Ave. • Lancaster, PA 17603 • 717/396 8922 • Fax 717/396 8746 • email@enviroscan.com • www.enviroscan.com

MID-ATLANTIC GEOSCIENCES • BOREHOLE GEOPHYSICAL LOGGING • a division of ENVIROSCAN, INC.

ENVIROSCAN, INC.®

February 25, 2008

"non responsive based on revised scope"

Tetra Tech EM Inc.
7 Creek Parkway
Suite 700
Boothwyn, PA 19061

RE: Geophysical Survey
Unexploded Ordnance Detection/Delineation
New Jersey Fireworks Site
Five (and Optional Sixth) Burn/Disposal Pit Areas
Totaling Approximately 5.4.Acres
Elkton, MD
Enviroscan Project Number 110721

Dear "non responsive based on revised scope"

Pursuant to our proposal dated November 15, 2007, Enviroscan, Inc. is pleased to present the final report for a geophysical survey of the above-referenced site. The purpose of the survey was to provide mapping of potential munitions/unexploded ordnance (UXO) anomalies, consistent with fuses from 100-lb. practice bombs, tracer elements from spotting rounds, and grenade fuses, pins, and spoons.

Site Description and Methodology

The survey consisted of five areas: Burn Pit Area 1 (2.3 acres, with an optional one-acre added here), Disposal Area 1 (0.2 acres), Disposal Area 2 (2.4 acres), Tracer Element Area (0.4 acres), and Burn Pit Area 2 (0.05 acres). Burn Pit Area 1, Disposal Area 1, and Tracer Element Area were open and grassy with some scattered surface debris (metallic and nonmetallic). Disposal Area 2 was moderately wooded with two shallow ponds and one area containing an intact structure encircled with a large amount of metallic surface debris. Burn Pit Area 2 was heavily vegetated with little open area.

[redacted]
February 25, 2008
Page 2

The original scope of work for this project proposed using a hand-towed Geonics EM-61MK2 metal detector survey in concert with GPS positioning of all areas except Disposal Area 2. Due to the underbrush and wooded areas in Disposal Area 2, Enviroscan proposed a conducting hand-gridded Geometrics G858 magnetometer survey (which is attached to the operator and is easily carried through underbrush). Enviroscan discovered, during initial equipment testing, that the nearby Amtrak railway high-tension line (approximately 100-900 feet to the south) was emitting electromagnetic (EM) fields that interfered with the performance of the EM-61 instrument. The instrument was tested off-site and a rental unit was brought in to perform further testing. The final conclusion was that the survey could not be performed with any EM-61 due the EM interference.

The scope of work was then altered such that all areas would be surveyed with a Geometrics G-858 "Magmapper" cesium vapor magnetometer (which was unaffected by the railway line). The magnetometer is sensitive only to ferrous metal. Note that possible on-site targets included some that may not have any ferrous metal content; therefore, to overcome this limitation, Enviroscan proposed to complete the magnetometer survey, process and present the draft magnetometer results, from which the client would select geotechnical investigation locations in areas clear of ferrous metal. Enviroscan would at that point remobilize, navigate to those locations, and further clear them with a hand-held metal detector sensitive to all metals to eliminate the possibility of encountering non-ferrous metal objects. The fieldwork for this project was completed on December 3-5, 7, and 10, 2007. The methods and site-specific procedures for the magnetometer (MAG) survey are detailed below.

[redacted] "non responsive based on revised scope"

Methods

Magnetometer Survey

Magnetic surveys are typically performed by recording the strength of the magnetic field at gridded stations or along profiles, and examining the field strength or total field data for anomalies. Note that at middle northern latitudes (e.g. Maryland), a magnetically susceptible, but non-hard-magnetized target will typically produce a paired high-low anomaly (dipole), with a generally north-south separation between the anomaly peak and trough. Hard-magnetized targets can produce arbitrarily-shaped anomalies dependent upon the strength and orientation of the target's internal magnetic field relative to the Earth's field. Targets with hard magnetization (e.g. non-impacted UXO, many pieces of ferrous hardware, and heated UXO, rocks, or other debris) produce complicated anomalies that may be dipoles (paired highs and lows) with an arbitrary azimuth between the peak and trough, or even apparent monopoles (i.e. a single positive or negative peak). The exact nature of the anomaly depends on the interaction between the object's magnetic field, the earth's magnetic field, and the induced magnetic field if the object is magnetically susceptible.

For this survey, gradient magnetic data were recorded using an array of two Geometrics G-858 MagMapper cesium vapor sensors at a height of 3.5 feet above the ground. Magnetic data were automatically recorded at 0.5-second intervals along profiles spaced approximately 4 feet apart. The two sensors were hand-carried on an aluminum pole with a vertical separation of 2.2 feet. Throughout the field survey, daily QA/QC tests were performed, including:

- an instrument functionality test in which the instrument's internal diagnostics were checked;
- an instrument and cable stability test in which the cables and sensors were shaken to check for shut-downs or data offsets;
- an operator cleanliness (in the magnetic sense!) test in which the operator was checked for magnetized and magnetically-susceptible materials such as belt buckles, keys, etc.;
- an instrument sensitivity test in which the instrument was carried at survey height over a 1-lb sledgehammer head to confirm detection; and

[redacted]

- a system latency test in which the instrument was carried in opposing directions over a known target to check for latency in the GPS positioning (see below).

Magnetic data are typically capable of detecting a 4-kilogram (kg) or 2-pound (lb) iron target to depths of 6 feet or greater, and can detect more massive targets to significantly greater depths, and smaller more subtle targets at lesser depths.

For all of the survey areas except Disposal Area 2, the actual location of each measurement station was digitally recorded using a Topcon RTK GPS system with sub-foot accuracy. For Disposal Area 2, the survey area was hand-gridded and selected locations were later surveyed with the RTK GPS. The gridded locations were then rotated into the survey grid system. The MAG stations are depicted as black crosses in Figure 1 in Maryland State Plane Coordinates (NAD-83 geodetic datum) in feet.

The MagMapper data were corrected for instrument layback, latency, and spurious field spikes due to operator motion (using MagMap2000 by Geometrics) to reveal the gradient magnetic field intensity, which equals the top sensor reading minus the bottom sensor reading. The magnetic field intensity (as described above) typically contains anomalies with complex outlines, which are not necessarily centered over the source object, for even simple targets. In order to produce simple anomalies centered on source objects, Enviroscan calculated the 3-dimensional total gradient or "analytic signal" from the magnetic intensity data. The analytic signal is a mathematical transform that produces a single peak response over a dipole target. While the units of magnetic intensity are gammas (with the Earth's ambient field having a strength of about 54000 gammas), the units of analytic signal are the same as magnetic gradient – gammas/foot. The analytic signal data were contoured using the minimum curvature routine in Oasis Montaj by Geosoft, and are depicted as color contours in Figure 2. These results were transmitted to the client in draft from so that geoprobe locations could be picked in areas clear of ferrous metal.

[redacted]

Follow-up Relocation and Ferrous Metal Detection

The client-designated geoprobe locations were relocated utilizing a Topcon GMS-110 GIS-grade GPS system. The locations were then scanned with a Fisher 1266-XB hand-held metal detector and a Schonstedt GA-72*Cd* Magnetic Locator. The Fisher 1266-XB is a dual coil, high-sensitivity, multipurpose small metal detector designed to easily locate small objects such as soda cans, rings, and small caliber ordnance, etc. For this survey the 1266-XB was utilized to scan geoprobe locations for non-ferrous metal (ferrous metal was detected in the MAG survey). The Schonstedt GA-72*Cd* Magnetic Locator was utilized to further clear each location for small-sized ferrous metal that may not have been detected in the prior survey.

Results

The magnetometer survey results are presented on Figure 2. The figures show the mapped magnetic analytic signal of each survey area (described above). Shades of green signify magnetic background indicating no ferrous metal is present. Increasing yellow to red to pink colors indicate the presence of ferrous metal. Anomaly size is related to both the size and depth of a ferrous object. Because a large, deep target may have the same magnetic anomaly size as a small, shallow target, the size and depth of that target cannot be determined from the magnetic anomaly data. The smallest target size that could be detected for this survey equates in size to a railway spike, which on this site can be detected up to 2 feet deep. As noted above, the magnetometer is only sensitive to the presence of ferrous metal and cannot detect non-ferrous metal or explosives.

The client-selected locations to screen for non-ferrous targets were scanned and staked-out on January 10, 2008. Their locations are shown on Figure 2. In addition, the coordinates of these locations are listed in Table 1. Note that only a few of the original locations had to be moved due to the presence of nonferrous metal.

non responsive based on revised scope

Limitations

The geophysical survey described above was completed using standard and/or routinely accepted practices of the geophysical industry and equipment representing the best available technology. Enviroscan does not accept responsibility for survey limitations due to inherent technological limitations or unforeseen site-specific conditions. However, we make every effort to identify and notify the client of such conditions and limitations.

As always, we appreciate this opportunity to have worked with you. If you have any questions, please do not hesitate to contact me.

Sincerely,
Enviroscan, Inc.

"non responsive based on revised scope"

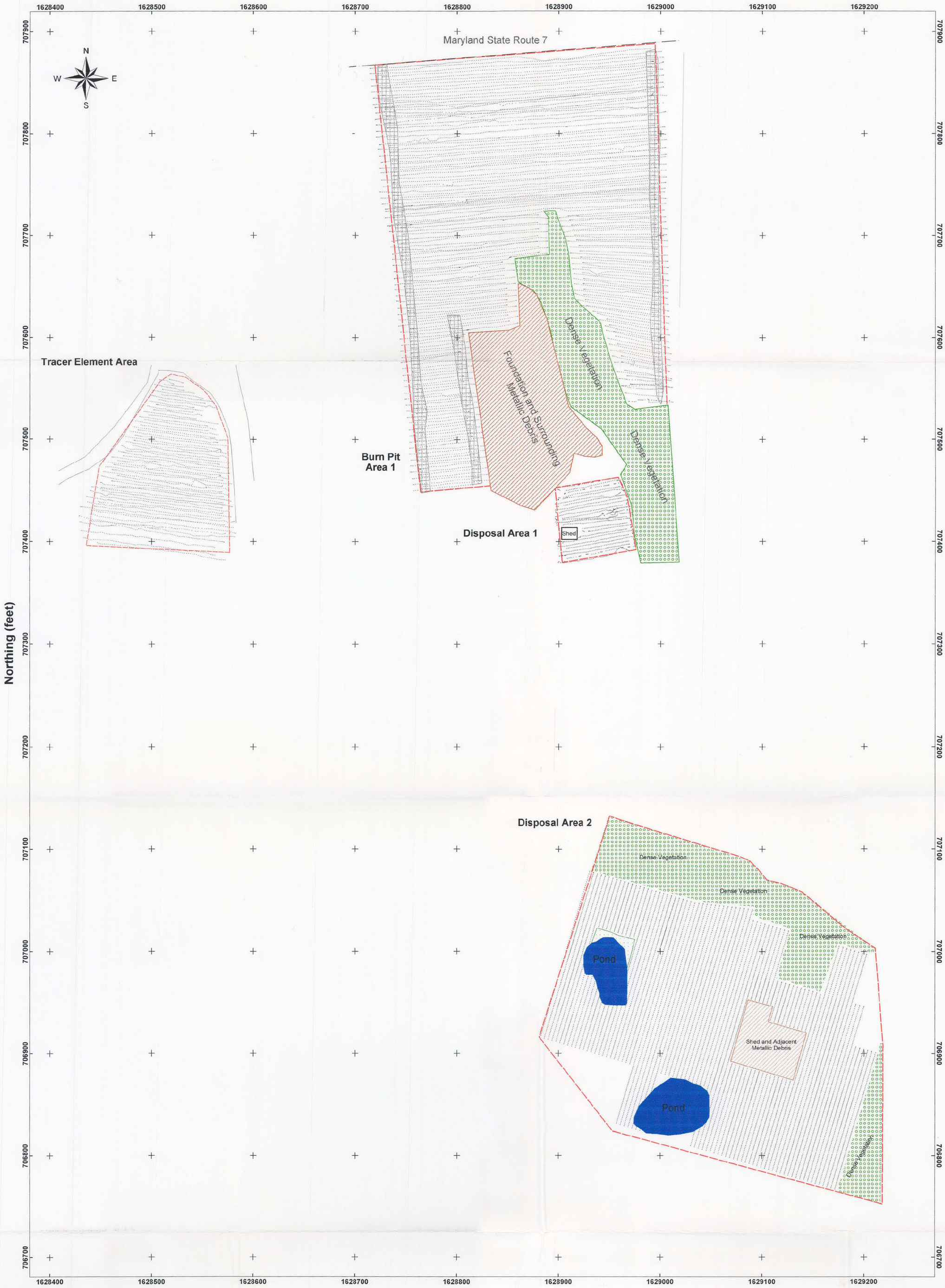
Senior Geophysics Project Manager

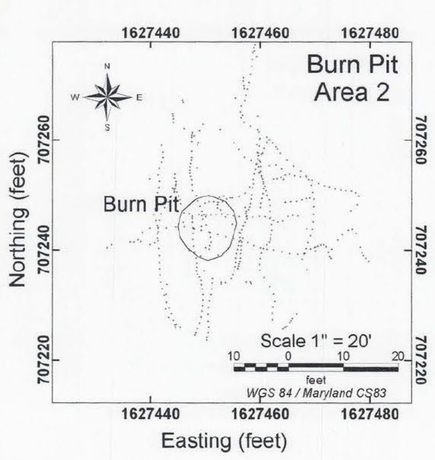
Technical Review By:
Enviroscan, Inc.

"non responsive based on revised scope"

Principal Geophysicist

enc.: Figure 1: Magnetic Survey Data Coverage
Figure 2: Magnetic Survey Analytical Signal
Table 1: Cleared Geoprobe Locations





- Magnetometer Survey Station
- Survey Boundaries
- Dense Vegetation (inaccessible)

Notes:

Coordinates in Maryland State Plane Grid, NAD83 datum.

Data collected with Geometrics G858 Magnetometer in gradient mode.

Basemap features from DGPS survey by Enviroscan, Inc.

Magnetic Survey Data Coverage

Figure 1

Rev. 02/14/08

New Jersey Fireworks Site
Elkton, MD

Enviroscan, Inc.
1051 Columbia Ave.
Lancaster, PA 17603

Enviroscan Project # 110721

Maryland State Route 7

Tracer Element Area

Burn Pit Area 1

Foundation and Surrounding Metallic Debris

Dense Vegetation

Disposal Area 1

Shed

Disposal Area 2

Pond

Shed and Adjacent Metallic Debris

Northing (feet)

Easting (feet)

Scale 1:600
25 0 25 50
feet
WGS 84 / Maryland CS83

- Survey Boundaries
- Dense Vegetation (inaccessible)
- Anomalies Resulting from Wire-Stem Flags
- 12 Geoprobe Location

Notes:

Coordinates in Maryland State Plane Grid, NAD83 datum.

Data collected with Geometrics G858 Magnetometer in gradient mode.

Basemap features from DGPS survey by Enviroscan, Inc.

Burn Pit Area 2

Burn Pit

Scale 1" = 20'
10 0 10 20
feet
WGS 84 / Maryland CS83

Magnetic Analytical Signal
Gammas/foot
-0.2 0.2 0.3 0.4 0.5 0.7 0.9 1.2 1.8 2.9 5.0 10.6
Increasing Ferrous Metallic Response

Magnetic Survey Analytical Signal

Figure 2
Rev. 02/14/08

New Jersey Fireworks Site
Elkton, MD

Enviroscan, Inc.
1051 Columbia Ave.
Lancaster, PA 17603

Enviroscan Project # 110721

Table 1
Cleared Geoprobe Locations

Coordinates in Maryland State Plane Grid, NAD-83 Datum

Geoprobe Number	Easting	Northing
1	1628899.001	707850.982
2	1628798.915	707803.669
3	1628952.683	707796.39
4	1628848.958	707749.987
5	1628749.747	707700.632
6	1628849.332	707701.886
7	1628962.165	707708.631
8	1628858.101	707641.846
9	1629000.383	707650.861
10	1628748.858	707601.089
11	1628949.723	707601.089
12	1628799.519	707549.54
13	1629005.716	707539.763
14	1628751.525	707505.101
15	1628799.519	707450.885
16	1628907.651	707448.082
17	1628942.765	707454.269
18	1628898.804	707400.803
19	1628948.706	707400.803
20	1628949.117	707050.499
21	1629005.414	706998.846
22	1629105.238	707002.908
23	1628898.625	706950.094
24	1628999.029	706951.255
25	1629099.434	706951.255
26	1629197.517	706945.451
27	1628949.117	706900.763
28	1629034.156	706914.068
28A	1629049.522	706900.763
29	1629143.542	706901.343
30	1629091.889	706850.27
31	1629122.312	706855.321
32	1629198.678	706849.69
33	1629049.522	706800.358
34	1629148.766	706794.554
35	1628528.055	707544.738
36	1628474.728	707500.742
37	1628524.5	707500.298
38	1628574.717	707499.854
39	1628468.95	707450.969
40	1628524.945	707450.525
41	1628575.162	707450.081
42	1628524.5	707400.308
65	1627458.636	707244.393
66	1627502.506	707227.952
67	1627453.072	707191.495
68	1627435.751	707221.17